Species Listing PROPOSAL Form:

Listing Endangered, Threatened, and Special Concern Species in Massachusetts

Scientific name: *Carex squarrosa*

Current Listed Status (if any): Watch List, previously State Historic

Common name: Squarrose Sedge

Proposed Action:
X Add the species, with the status of:
Threatened
_____Remove the species
_____Change the species' status to: _____

Change the scientific name to: _____
Change the common name to: _____
(Please justify proposed name change.)

Proponent's Name and Address:
Karro Frost
Plant Conservation Biologist
Natural Heritage and Endangered Species Program
1 Rabbit Hill Road
Westborough, MA 0158

Phone Number: 508-389-6390
Fax:

E-mail: karro.frost@state.ma.us

Association, Institution or Business represented by proponent: Natural Heritage and Endangered Species Program, DFW.

Proponent's Signature:

Date Submitted: 7/6/2018

Please submit to: Natural Heritage & Endangered Species Program, Massachusetts Division of Fisheries & Wildlife, 1 Rabbit Hill Road, Westborough, MA 01581

Justification

Justify the proposed change in legal status of the species by addressing each of the criteria below, as listed in the Massachusetts Endangered Species Act (MGL c. 131A) and its implementing regulations (321 CMR 10.00), and provide literature citations or other documentation wherever possible. Expand onto additional pages as needed but make sure you address all of the questions below. The burden of proof is on the proponent for a listing, delisting, or status change.

(1) **Taxonomic status.** Is the species a valid taxonomic entity? Please cite scientific literature.
The species was named by Carl Linnaeus in 1753 in Species Plantarum 2, pg 973.
More recent references include:
Haines, Arthur. 2011. New England Wild Flower Society's Flora Novae Angliae. Yale University Press, New Haven.
Gleason, Henry A., and Arthur Cronquist. 1991. Manual of Vascular Plants of Northeastern United States and Adjacent Canada, Second Edition. The New York Botanical Garden. Bronx, N.Y.
There has been no changes in the taxonomy of the species.

(2) Recentness of records. How recently has the species been conclusively documented within Massachusetts?

Prior to 2016, the species was last observed in 1989 near Governors Drive, Amherst, recorded by a specimen collected by Claire Johnson at the MASS herbarium. Her specimen was apparently unknown by previous State Botanists. Prior herbarium specimens include one in 1930, collected by Francis R. St. John in Northampton, and one in 1927, collected by A.S. Goodale in South Hadley. The species was assumed to be extirpated from the state and was ranked at SH until 2016, when its Subnational Rank was changed to S1.

In Massachusetts, three obserrvations have been submitted to the VPRS reporting system:

2017. Montague, Powerline. VPRS record P4164.

2016. South Hadley, floodplain forest. VPRS record P3318.

2016. Northampton, floodplain forest. VPRS record P3288.

Of these, the two found in 2016 indicate natural occurrences and are in basically the same location where the species was observed in the 1800s on many different herbaria sheets. The 2017 record is a location where work has recently occurred and there is the potential that the species may have been accidentally introduced by power line equipment. Additional site assessment will be completed if the species is listed to determine whether this is a natural occurrence.

(3) Native species status. Is the species indigenous to Massachusetts?

Yes, the species is indigenous to Massachusetts. It had been collected in Massachusetts by some of the earliest collectors, including Edward Tuckerman, who was collecting in the mid-1800s.

(4) Habitat in Massachusetts. Is a population of the species supported by habitat within the state of Massachusetts?

Yes, there are at least two habitat types that support this species.

Gleason and Cronquist (1991) describe the habitat as "swampy woods and thickets;" Angelo and Bufford (2007) describe its habitat as "Meadows and low woods."

Kearsley 1999 states that the species closely associated to this species, *Carex typhina*, similar in appearance and habitat, is typically found in two floodplain forest types: "Transitional floodplain forests" and "Small-river floodplain forests," both of which are community types found in Massachusetts.

In Massachusetts, its habitat appears to be mostly Floodplain Forests, associated with the Connecticut River. It has also been found within disturbed sites, i.e., a construction site on the UMass Amherst campus (1989) and a powerline reconstruction site in Montague (2017). In addition, the 1887 collection by Walter Deane in Cambridge describes it as a waif.

(5) Federal Endangered Species Act status. Is the species listed under the federal Endangered Species Act? If so, what is its federal status (Endangered or Threatened)

Carex squarrosa is neither listed under the federal Endangered Species Act, nor is it proposed for listing under the federal Endangered Species Act.

(6) Rarity and geographic distribution.

(a) Does the species have a small number of occurrences (populations) and/or small size of populations in the state? Are there potentially undocumented occurrences in the state, and if so, is it possible to estimate the potential number of undocumented occurrences?

C. squarrosa currently is known from only three locations in Massachusetts, all known populations seem to be small, but an accurate count of plants was not completed. It is likely that there are additional populations, and that it may have been overlooked by field botanists in the recent past due to its similar appearance to *Carex typhina* (Hickler, pers. comm. 2018). These species are found in similar habitats, and may grow in close proximity to each other. *C. typhina* populations may intermingle with *C. squarrosa* at some sites. *C. typhina*, which is currently ranked as Threatened, has only been observed in 12 locations in the state. Herbarium specimens can be used to illustrate the species historical range. Herbarium specimens for *C. squarrosa* record the species in Cambridge, Waverly (near the Waltham, Belmont town lines), Amherst, Hadley, South Hadley and Northampton. It is likely that there are additional undocumented populations in Massachusetts, as it was listed as State Historic from the inception of the state rank system until 2016.

(b) What is the extent of the species' entire geographic range, and where within this range are Massachusetts populations (center or edge of range, or peripherally isolated)? Is the species a state or regional endemic?

C. squarrosa is not a state or regional endemic. In New England, it is known from Connecticut (where it is a Species of Special Concern) and, historically from Rhode Island, as well as Massachusetts. It is considered sufficiently common in New York State, particularly eastern NY, that it is ranked as S5, and has no protection. Its full range extends from Massachusetts south to Georgia, west to Louisiana, and north to Minnesota, and historically in Ontario. Thus, Massachusetts represents the species' northeastern-most extent.

(7) Trends.

(c) Is the species decreasing (or increasing) in state distribution, number of occurrences, and/or population size? What is the reproductive status of populations? Is reproductive capacity naturally low? Has any long-term trend in these factors been documented?

Currently, there are no long-term data of the status of the populations in the state. The historic herbarium specimens do not include number of plants observed, and the recent observations mostly have not included total plant counts within a population, as the observations were part of targeted surveys for other species.

(8) Threats and vulnerability.

(d) What factors are driving a decreasing trend, or threatening reproductive status in the state? Please identify and describe any of the following threats, if present: habitat loss or degradation; predators, parasites, or competitors; species-targeted taking of individual organisms or disruption of breeding activity.

The threats to the continuation of this species survival in Massachusetts have not been studied, thus the following comments are speculations based on other species.

Often the primary factor driving a decrease in a species is loss of habitat. Historically, floodplain forests were cleared and farmed, resulting in a loss of all species associated with that location. Currently under the state Wetlands Protection Act enacted in 1970, wetlands in Massachusetts are better protected than in the past, but construction in the uplands still has the potential to impact wetland systems, and sedimentation into these floodplain forests remains a threat. Given that this species occasionally occurs in anthropogenic disturbed habitats, it is unknown whether this benefits the species or not.

An additional threat may be the density of the forest canopy as there has been less disturbance of large river floodplain forests due to the number of dams that restrain large flood events. The canopy may be providing an abundance of shade and preventing sedge species from reproducing successfully. For many of Massachusetts rare forest occuring species, this seems to be an important factor, though it is unknown for this species.

Large population increases of white-tailed deer in the past 40 years has had the affect of favoring fern populations. Ferns such as ostrich fern and sensitive fern, common in river floodplains, are chemically defended against herbivory, creating a strong selective pressure for consumption by deer

of non-fern species, transforming areas of the understory into thick, monotypic fern glades (Frost, Wernerehl, pers. observation in Fanny Stebbins, 2017).
Competition with invasive species is another potential threat. Many floodplain forests have been overrun with invasive plant species, such as *Lonicera morrowii*, *Rosa multiflora*, *Lysimachia nummularia*, *Celastrus orbiculatus*, *Berberis spp.*, *Rhamnus frangula*, *Fallopia japonica* and *Fallopia xbohemica.*

(e) Does the species have highly specialized habitat, resource needs, or other ecological requirements? Is dispersal ability poor?
Carex squarrosa does have specialized habitat requirements found in Floodplain Forests: forest cover to provide some shade and slow floodwaters; regular soil enrichment from flood events; wet soils; and likely other elements botanists have not yet determined. Ford and Reznicek (2002) describe that *C. squarrosa* occurs in slightly drier habitats compared to *C. typhina.* Sedges with inflated perigynia, such as *C. squarrosa* and *C. typhina*, are thought to use floodwaters to disperse their seeds which float on the surface of the water. The long beaks may also get tangled in animal fur that is brushed against the shattering seed head. The exact habitat requirements for *C. squarrosa* have not been assessed.

Conservation goals.

What specific conservation goals should be met in order to change the conservation status or to remove the species from the state list? Please address goals for any or all of the following:

(a) State distribution, number of occurrences (populations), population levels, and/or reproductive rates
Massachusetts currently has three known occurrences, of unknown sizes. In order for this species to be removed from the MESA List, at least 20 populations consisting of 50 or more plants (ranked as B or better) would need to be observed to establish that the species is well established in the state.

(b) Amount of protected habitat and/or number of protected occurrences
The goal would be to have the majority of the floodplain forests/wetlands where the species occurs and the adjacent 100 to 300 feet protected. Currently, only one of the populations is on protected land, which is owned by Mass Audubon.

(c) Management of protected habitat and/or occurrences
The Management needs of this species have not yet been assessed.

Literature cited, additional documentation, and comments.

Angelo, R., and D. Bufford. 2007. Átlas of Flora of New England: Cyperaceae. Rhodora, Vol. 109, No. 939, pp. 237–360.

Consortium of Northeastern Herbaria [web application]. http://neherbaria.org/ . Accessed February 15, 2018.

Dow Cullina, M., Bryan Connolly, Bruce Sorrie and Paul Somers. 2011. The Vascular Plants of Massachusetts: A County Checklist First Revision. Massachusetts Natural Heritage and Endangered Species Program. Massachusetts Division of Fisheries and Wildlife.

Dreyer, G.D. and C. Jones, et. al. 2014. Native and Naturalized Plants of Connecticut Checklist. Connecticut Botanical Society. New Haven, CT.

Ford, Bruce A., and A.A. Reznicek. 2002. Section 26uu. Linnaeus sect. SQUARROSAE J. Carey, Carices North. *In* Flora of North America Editorial Committee. 2002. Flora of North America, North of Mexico. Volume 23 Magnoliophyta: Commelinidae (in part): Cyperaceae. Oxford University Press. New York. pp. 519.

Gleason, Henry A. and Arthur Cronquist. 1991. Manual of Vascular Plants of Northeastern United States and Adjacent Canada, Second Edition. The New York Botanical Garden, New York.

Haines, Arthur. 2011. Flora Novae Angliae. New England Wild Flower Society. Yale University Press, New Haven and London.

Kearsley, Jennifer B. 1999. Rare and Non-Native Plants of Massachusetts' Floodplain Forests. Rhodora, Vol. 101, No. 906, pp. 200-205.

NatureServe. 2017. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://explorer.natureserve.org (Accessed: February 15, 2018).

New England Wild Flower Society. 2011-2018. Go Botany website: https://gobotany.newenglandwild.org/ Accessed 15 February, 2018.

NHESP. 2016. Transitional Floodplain Forest Community Fact Sheet: https://www.mass.gov/files/documents/2016/08/no/transitional-floodplain-forest-fs.pdf. Accessed 15 February, 2018.

NHESP. 2016. Small-river Floodplain Forest Community Fact Sheet: https://www.mass.gov/files/documents/2016/08/oe/small-river-floodplain-forest-fs.pdf Accessed 15 February 2018

The vPlants Project. vPlants: A Virtual Herbarium of the Chicago Region. http://www.vplants.org Copyright © 2001–2009 The vPlants Project, All Rights Reserved. Accessed 15 February, 2018.

Young, Stephen. 2018. Personal communication regarding Carex squarrosa in New York state.